FORM PTO-1390 (REV. 11-2000) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY 'S DOCKET NUMBER	
1178-2	
U S. APPLICATION NO (If known, see 37 CFR 1 5	
10/049448	
INTERNATIONAL APPLICATION NO. PCT/KR99/00717	INTERNATIONAL FILING DATE 29 NOVEMBER 1999
PRIORITY DATE CLAIMED 19 AUGUST 1999	

TITLE OF INVENTION RECIPROCATING SAW FOR USE IN VARIABLE ANGLE AND MULTIPLE DIRECTION

APPLICANT(S) FOR DO/EO/US Hee-young LEE

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☒ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information: Forms PCT/IPEA/416 & PCT/IPEA/409

CERTIFICATION UNDER 37 C F R § 1 10

I hereby certify that this correspondence and the documents referred to as enclosed are being deposited with the United States Postal Service on date below in an envelope as "Express Mail Post Office to Addressee" Mail Label Number EV035531640US addressed to Commissioner for Patents, Box PCT, Washington D C. 20231

Dated: February 12, 2002

(Name) Michael J Musella

U.S. APPLICATION NO (If known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/049448	PCT/KR99/00717	1178-2

21. ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		CALCULATIONS PTO USE ONLY
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	$1040.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	$890.00	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	$740.00	
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)	$710.00	
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)	$100.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =		$ $1,040.00
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	$
Total claims	13 - 20 =	0	x **$18.00**	$ $0.00
Independent claims	2 - 3 =	0	x **$84.00**	$ $0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$280.00**	$ $0.00
TOTAL OF ABOVE CALCULATIONS =				$ $1,040.00
☒ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	$ -$520.00
SUBTOTAL =				$ $520.00
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$
TOTAL NATIONAL FEE =				$ $520.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$
TOTAL FEES ENCLOSED =				$ $520.00
			Amount to be refunded:	$
			charged:	$

a. ☒ A check in the amount of $ $520.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 04-1121 in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 04-1121 . A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

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33,494
REGISTRATION NUMBER

Attorney Docket No. 1178- 2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(s):	LEE, Hee-young
INTERNATIONAL APPLICATION NO.:	PCT/KR99/00717
FILED:	29 November 1999 **DATE:** February 12, 2002
FOR :	RECIPROCATING SAW FOR USE IN VARIABLE ANGLE AND MULIPLE DIRECTION

Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination of this application, please enter the following Preliminary Amendment.

IN THE SPECIFICATION:

Please accept the attached substitute specification, to replace the specification as filed. A marked-up copy of the specification is also attached, showing changes to the specification in brackets for material that was deleted, and underlined for material that was added.

CERTIFICATION UNDER 37 CFR §1.10

I hereby certify that this correspondence and the documents referred to as enclosed are being deposited with the United States Postal Service on date below in an envelope as "Express Mail Post Office to Addressee" Mail Label Number EV035531640US addressed to Commissioner for Patents, Box PCT Application, Washington, D.C. 20231.

Dated: February 12, 2002

Michael J. Musella

IN THE TITLE:

Please change the Title to: RECIPROCATING SURGICAL TOOL FOR USE AT VARIABLE ANGLES AND IN MULTIPLE DIRECTIONS.

IN THE CLAIMS:

Please accept amended Claims 1- 4 as follows:

1. A reciprocating surgical tool for use in an oral cavity operation, comprising a handle, a neck extending from said handle at a first end, and a head case coupled to a second end of said neck; a motor mounted inside of said handle; a slider shaft mounted inside of said head case having have an angle of approximately 90° with respect to a longitudinal axis of said neck; a slider movable in a linear reciprocating direction along said slider shaft; a tool member mounted to said slider for performing said oral cavity operation; and a power linkage device coupled between said slider and said motor for converting rotation power of said motor into linear reciprocating movement of said slider, whereby a direction of the oral cavity operation performed by said tool member mounted to said slider forms an angle of approximately 90° with respect to the longitudinal axis of the neck.

2. A reciprocating surgical tool according to Claim 1, wherein said power linkage device comprises a linkage shaft inserted into said neck, such that both ends of said linkage shaft are supported by a bearing, one end of said linkage shaft being directly coupled to said motor while the other end of said linkage shaft has an expanded member at which an eccentric groove is formed, and a pin, a first bent end of the pin being inserted into said eccentric groove

of said expanded member and a second bent end of the pin being inserted into an eccentric groove of said slider, respectively.

3. A reciprocating surgical tool according to Claim 1, wherein said power linkage device comprises a gear element connected to a rotation shaft of said motor so as to convert the direction of rotation movement of said motor into a right angle; an eccentric wheel shaft coupled to an end of said gear element; and an L-shaped link located within said head case, such that an arrest point of said L-shaped link is fixed to said head case by a first hinge, an upper end of said L-shaped link being coupled to said slider by a second hinge, and a lower end of said L-shape link being connected to an eccentric wheel by a rod.

4. A reciprocating surgical tool according to Claim 1, wherein said power linkage device comprises an eccentric wheel coupled to an end of said motor; and a second slider for linear reciprocating movement along a slider shaft being position within said handle for coupling to said eccentric wheel; and wherein said slider and second slider are connected by a lever having at a center thereof a rotation shaft.

Please add new Claims 5-13 as follows:

5. A reciprocating saw for use in an oral cavity bone cutting operation, comprising:

a handle;

a motor;

a linkage for converting rotating power of said motor into linear reciprocating

movement;

a slider shaft mounted at and end of said linkage having an angle of approximately 90° with respect to the linkage; and

a slider, for attaching one of a saw and a file, which moves reciprocatingly along said slider shaft, whereby a direction of a bone cutting operation performed by the saw or file attached to said slider forms an angle of approximately 90° with respect to a longitudinal axis of said handle.

6. A reciprocating saw according to Claim 5, further comprising a switch for turning on/off the motor.

7. A reciprocating saw according to Claim 5, wherein said linkage includes:

a linkage shaft connected between the motor and the slider for transmitting the rotating power from the motor to the slider;

the slider having at least one eccentric groove; and

a pin having a pair of bent ends, such that one bent end is inserted into the eccentric groove of the slider while the other end is inserted into an eccentric groove of the linkage shaft, whereby the rotating power of the motor is converted into linear reciprocating movement of slider.

8. A reciprocating saw according to Claim 7, further comprising at least one bearing to support the linkage shaft.

9. A reciprocating saw according to Claim 7, wherein the linkage has a curved shape for adjusting a working direction and bone cutting direction.

10. A reciprocating saw according to Claim 5, wherein the linkage includes:

a gear element consisting of two gears perpendicularly engaged with each other , one of which is connected to a rotation shaft of said motor and the other of which connected to an eccentric wheel shaft, in order to convert a direction of rotation movement of said motor into a right angle;

the eccentric wheel shaft being connected to a rod so that the rotating power of the gear is transferred to the rod;

the rod being connected to a lower portion of an L-shaped link so that the reciprocating movement of the rod is transmitted to the lower portion of the L-shape link; and

an upper portion of the L-shaped link being connected to the slider such that it pivotably moves up and down along the slider by transmitted movements of the rod through a hinge, whereby the rotating power of the motor is converted into a linear reciprocating movement of slider.

11. A reciprocating saw according to Claim 10, wherein the L-shape link is installed in a head case at an end of the linkage opposite said handle.

12. A reciprocating saw according to Claim 5, wherein said linkage includes:

a eccentric wheel coupled to an end of the motor; and

a second slider connected to the eccentric wheel and for reciprocating movement along the slider shaft; wherein the slider is connected to the second slider by a lever having at a center thereof a rotation shaft.

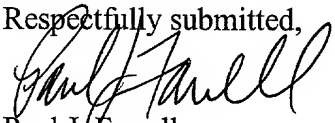
13. A reciprocating saw according to Claim 12, wherein the lever has a bent shape.

REMARKS

By this Amendment, it is respectfully requested that the substitute and amendments to the Claims and Title be entered prior to examination of this case. Claims 1-4 have been amended and claims 5- 13 have been added. No new matter has been added by this amendment, and the amendments made were to place the application into proper form and to correct numerous grammatical errors. Favorable consideration of the application as amended is respectfully requested. Early favorable action is earnestly solicited.

Should the Examiner feel that a telephone or personal interview may facilitate resolution of any remaining matters, he is respectfully requested to contact Applicant's attorney at the number indicated below.

Respectfully submitted,



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Marked-up Version of Specification in Accordance with

Requirements under 37 C.F.R. §1.121

RECIPROCATING SURGICAL TOOL [SAW] FOR USE AT [IN] VARIABLE ANGLES AND [IN] MULTIPLE DIRECTIONS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a [reciprocating] surgical saw for use in [cutoff of oral cavity bone] a bone cutting operation, and more particularly, to a reciprocating saw for use in cutting [off of] oral cavity bone, [in which] when an oral cavity bone cutting operation [can be] is performed by a linear reciprocation movement [at] of the reciprocating saw blade without [being restricted] restriction within an approach direction.

2. Background Art

Reciprocating saws for surgical cutting operations of oral cavity bone [is] are [mainly] commonly used in plastic surgery. Since a bone cutting operation is preferably performed in a narrow space of the oral cavity, it is required to minimize the size of the reciprocating saw used therein. In addition, the optimization [in] of bone cutting directions [affects] significantly affects [to] the degree of difficulty, in a required limited time period, and pre-treatment for a surgical operation will also add to optimization of the procedure. However, a conventional surgical [cutter] cutting saw does not provide such [an] optimization of the surgical procedure.

As a conventional saw for surgical cutting operations, there [is] are a sagittal saw, the saw blade of which is formed in the same direction as a handle thereof, as shown in FIG. 10,

and an oscillating saw, the saw blade of which [saw blade] is formed to allow cuttings in a perpendicular direction with respect to a handle of the saw, as shown in FIGS[s]. 11a and 11b even though the saw is installed the same direction as the handle thereof. The sagittal saw [type] has a problem in that changing cutting directions [change] is not easy and [an] a large external cutoff portion [becomes large] is inevitable [so as] to ensure a certain space required for [insertion] inserting a saw and [bone] cutting a bone [since] because the approach direction of the saw is the same as the direction of cutting a bone [and bone cutting direction are the same]. The oscillating saw also has a problem in that the efficiency of the cutting operation is low and determining[ation on] the direction for bone cutting is extremely difficult to form a circular shape [since cut-off portion is formed as a circular shape].

For example, when a protruding[ed] portion of a mandible 100 has to be removed by being cut in a circular shape, the sagittal saw has [shows] an excellent cutting force. However, as shown in FIG. 10, an additional cut-off portion 101 is required to be formed at an outer skin, which delays a recovery time period and makes the surgical operation more complicated. The oscillating saw is advantageous in that the pre-cutoff portion can be minimized by inserting the saw blade thereof after partially cutting the oral cavity (oral cavity cutoff portion 102). However, as shown in FIG. 11a, when an upper portion of the mandible is cut-off (at point p), the saw handle is caught by the oral cavity cutoff portion 102, which causes difficulty in determining [determination on] directions and angles.

A typical oscillating saw is generally used [employed] when a bone cutting operation is performed in a direction of an angle different from the direction of the saw handle. However, if the angle is not perpendicular to the handle, i.e., if the angle is not 90° with respect to the handle, or a circular action is partially included, [thus making] the cutoff operation is

inefficient. (R[r]eferring to FIG. 11b, when the cutting operation is to be performed in x-axis direction, the efficiency of cutting operation is degraded since a circular action occurs, forming an arc at x-y surface.)

Summary of the Invention

Therefore, it is an object of the present invention to allow an easy change in cutoff angle in a narrow space, minimization of a [in] pre-cutoff portion, and enhancement in [an] [in]efficiency of the cutoff operation.

To accomplish the above object of the present invention, there is provided a reciprocating saw for use in a cutoff procedure for [of] oral cavity bone, [in which] when the saw blade operation portion has a minimized size so as to allow for its [an] effective use in a narrow space, and a saw blade or a file reciprocates linearly while [at a state] maintaining a predetermined angle with respect to an approach direction, to thereby allow a free setup of bone cutting directions.

Brief Description of the Drawings

FIG.1 is a side sectional view of [illustrates a basic configuration of] a reciprocating saw according to the present invention;

FIG. 2a is a side elevational view of [illustrates an external shape of] the reciprocating saw shown in FIG[ig]. 1;

FIG. 2b is a side partial sectional view of [illustrates] a reciprocating saw having two slider axes according to a[n] preferred embodiment of the present invention;

FIG. 3 is an exploded perspective view [illustrating a configuration] of a slider coupling portion for the saw blade according to the present invention;

FIG. 4 is a side sectional view of [illustrates] a modified configuration of a reciprocating saw shown in FIG. 1 [according to the present invention];

FIG. 5 illustrates several types of saw blades and files for use with [adopted to] the present invention;

FIG. 6 is a side sectional view of another preferred embodiment of [illustrates] a reciprocating saw according to [another embodiment of] the present invention;

FIG. 7 is a side sectional view of [illustrates] a modified configuration of the reciprocating saw shown in FIG. 6;

FIGS[s]. 8a and 8b are sectional views of [illustrate still] another preferred embodiment of the present invention;

FIG. 9 is a side elevational view showing the reciprocating saw [illustrates a state where] when the reciprocating saw of the present invention is in use [applied]; and

FIGS[s]. 10, 11a, and [through] 11b illustrate configurations and use states of a conventional sagittal saw and a[n] conventional oscillating saw.

DETAILED DESCRIPTION OF THE PREFERED EMBODIMENTS [invention]

A preferred embodiment of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, like reference numerals identify similar or identical elements throughout the several views, while well-known functions or constructions are not described in detail so as not to obscure the invention in unnecessary detail.

Referring to FIGS[s]. 1 through 3, a reciprocating saw of the present invention includes a handle 1, a neck 2 which is extended from the handle 1, and a head case 3 coupled to [an] the other end of neck 2. In detail, handle 1 [has] includes [inside thereof] in the case of the handle 1, a motor 4, and head case 3 [has] includes [inside thereof] a slider shaft 5 which forms an angle of approximately 90° with respect to longitudinal direction of the neck 2. Slider 6 is mounted on slider shaft 5, and saw blade 8 is mounted to slider 6 to perform a linear reciprocating cutting motion along the slider shaft 5. Slider 6 and motor 4 are connected by a power linkage device 7 for converting the rotating[on] power of motor 4 into a linear reciprocating cutting motion of slider 6 and transmitting the converted motion[. Thus,] to a saw 8 or a file 9 attached to the slider 6, which performs a liner reciprocating cutting motion.

Handle 1 is preferably shaped as a cylinder to which the force of an operator is applied when a bone cutting operation is performed. Handle 1 includes in the cylinder case of handle 1 [inside thereof] a motor 4, and outside thereof a switch 1a which turns on/off the motor 4 so as to control the cutting operation of the reciprocating saw.

Neck 2 connects the head case 3 with the handle 1, and is extended from the handle 1 in such a manner that the size of neck 2 is minimized to facilitate [so as not to disturb] the movement of the reciprocating saw in the cutting operation when the saw is deeply inserted into an oral cavity. Components of power linkage device 7 are arranged [inside of] in the neck 2.

Neck 2 [can] may be formed in a straight linear type, or in a bent type if necessary, as shown in FIG. 4. In a bent type neck, it is possible to adjust a proceeding direction (approach direction) of the neck and a linear movement direction (bone cutting direction) of the saw blade by the bent angle of the neck.

Head case 3 provides [is for ensuring] a movement space for [of] slider 6, and is structured to have a minimum size within a scope of allowing a minimum stroke distance of the saw, so that a smooth operation of the saw can be achieved when the saw is inserted into an oral cavity.

When the range of the stroke pitch distance [of the saw] is 2.5mm to 3mm (which is the same as the stroke pitch distance of the slider; designated [denoted] as "L" in FIG. 1), the head case has a width of approximately 5mm and a length of approximately 12mm [in a sectional surface], thus ensuring a greater movement space for [of] the slider to maximize the [and the minimum] stroke pitch distance of the saw. Furthermore, free control of the bone cutting directions and angles can be achieved.

Referring to FIG. 3, s[S]lider shaft 5 is installed in[side of] the head case 3 in order to induce a linear movement of slider 6. Here, the slider shaft 5 is preferably shaped as a hexagon [in sectional surface] so as not to be warped during a linear reciprocating movement of slider 6. When the neck 2 is a straight line type, the slider shaft 5 may have a variation of approximately 90° with respect to the neck 2, to thereby achieve a variety of bone cutting directions in conformity with the shapes of cutting portions of the bones.

The above-mentioned hexagonal shape of the slider shaft is for preventing a warpage during slider movements, and can be preferably formed as a cylindrical shaft as shown in FIG. 2b[a], wherein two slider axes [are] may be arranged in parallel to each other so as to prevent [a] warpage.

Slider 6 performs a linear reciprocating movement along the slider shaft 5 within the head case 3, and has preferably a hexagonal perforation 6a penetrating through a body of slider 6. Slider shaft 5 is assembled into the perforation 6a.

At an outer surface of slider 6, at least one [a] screw hole 6b is formed for a replacement mounting of a saw blade or a file.

Saw blade 8 or file 9 serves to cut a bone, and has at an end portion thereof at least one [a] coupling hole 8a or 9a so as to be coupled to the slider 6 using at least one [a] screw 10, [.] as seen in FIG. 5, which illustrates saw blades 8 and files 9, both of which can have various shapes if necessary.

In the present invention, various embodiments are possible according to the configurations of power linkage device 7 for converting rotation power to a linear reciprocating movement of slider 6 and transmitting the converted movement. Power linkage device 7, as shown in FIGS[s]. 1 through 3, [is those which] converts the rotating[on] movement of motor 4 to a reciprocating movement of slider 6 using a linkage shaft 71a. Here, linkage shaft 71a is inserted into [inside of] the neck 2, so that both ends of linkage shaft 71a can be supported by [a] bearings 71b. At such a state, one end of linkage shaft 71a is directly coupled to the motor 4 while the other end of linkage shaft 71a has an expanded member 71c at which an eccentric groove 71d is formed. Slider 6 also has an eccentric groove 6c, and both bent ends of a pin 71e are inserted into the eccentric grooves 71d and 6c, respectively.

In the thus-structured power linkage device, rotating[on] movement of motor 4 is transmitted to linkage shaft 71a, thus providing pin 71e with an eccentric movement at an end of linkage shaft 71a. Then, slider 6 to which the eccentric movement of pin 71e is transmitted slides along slider shaft 5 and thus moves in linear reciprocation perpendicular to linkage shaft 71a. Such a linear reciprocating movement of slider 6 is transmitted to the file or saw blade attached thereto, to thereby perform a bone cutting operation.

Such a power linkage device has a[n extremely] simplified structure, providing conversion of rotating[on] movement of motor into a linear reciprocating movement, and thus minimization of neck size.

As shown in FIG. 4, a linkage shaft may be formed in a flexible cable shaft 71a', so that rotation thereof is enabled even when the neck portion is bent by a predetermined angle. This allows diversity of angles in approach directions and bone cutting directions.

The power linkage device shown in FIG. 6 has another preferred [a] structure in that the handle portion converts rotation movement of motor 4 to a linear reciprocating movement at the slider using a link node.

That is, a gear element 72a connected to a rotation shaft of motor 4 converts the direction of rotating[on] movement of motor 4 into a right angle. Then, an eccentric wheel shaft 72b is coupled to an end of gear element 72a. [, and an] L-shaped link 72c is employed inside of head case 3, so that the arrest point of link 72c can be fixed to head case 3 by a hinge 72d and the upper end of link 72c can be coupled to the slider 6 by a hinge 72e. The lower end of link 72c is connected to the eccentric wheel by a rod 72f.

In t[T]he above-described configuration, [is that] the eccentric wheel shaft 72b [rotates] is rotated in accordance with the rotation of motor 4, and the rod 72f connected thereto performs crank movements [up and down] back and forth. Then, the crank movement is transmitted to a linear reciprocating movement by link 72c, thereby linearly reciprocating slider 6.

The above-described configuration is advantageous in that a gear element which is required for changing the direction of power is provided to a handle portion which is not directly related to a bone cutting operation. In addition, internal components of the [a] head

case to be directly inserted into bone cutting portion is formed of a thin plate, to thereby minimize the sizes of the head case and handle portion.

FIG. 7 illustrates a modified configuration of the embodiment shown in FIG. 6 where slider shaft 5 is slanted with respect to neck 2. Here, a bone cutting direction is varied by an angle of approximately 90° with respect to the approach direction, and the angle of 90° may be reduced if necessary. Such a configuration may be applied [in] regardless of the configuration of a power linkage device, and is effective for [bone] cutting a bone in a narrow portion.

FIG. 8a illustrates another preferred configuration of a power linkage device for converting a rotation movement of the motor into a straight linear movement using a lever 73e moving from right and left in the drawing. An eccentric wheel 73a is coupled to an end of motor 4, and a second slider 73c which performs a straight linear reciprocating movement along a slider shaft 73b is arranged inside of handle 1 and connected to eccentric wheel 73a. Slider 6 and second slider 73c are connected by a lever 73e having at a center thereof a rotation shaft 73d.

The modified configuration of the embodiment as shown in FIG. 8b is also possible, wherein the power linkage device is bent at a center thereof focused in rotation shaft 73d.

In such a configuration, the eccentric wheel and the second slider constitute a cam element so that the rotating[on] movement of the eccentric wheel can be directly converted into a straight linear reciprocating movement of the second slider. In addition, the slider which constitutes a saw blade operation portion is provided with a straight linear reciprocating movement by the lever which performs an angular movement being centered at rotation axis 73d.

The above-described configuration is minimally disadvantageous in that a neck portion thereof becomes more or less larger since displacement at both ends of the lever becomes larger. However, the head case is formed integrally with the neck portion so as to allow a more smooth operation, and the width of the neck portion is increased in accordance with the displacement of lever being centered at the rotation axis which has least displacement, to thereby provide a wide field of view when the operation is performed [performing operation].

FIG. 9 illustrates a state of cutting the protrusion of a mandible into a circular shape using the reciprocating saw of the present invention. Here, oral cavity cutoff portion 102 is cut off first, and the saw blade is inserted thereinto. Then, the direction of the handle is appropriately adjusted in order to perform a cutting operation.

The direction of bone cutting to be performed by the saw blade is adjusted by means of appropriately adjusting the handle, and the direction of bone cutting forms an approximately 90° angle with respect to the approach direction of the handle. Therefore, free change in direction being centered from oral cavity cutoff portion 102 as an axis is allowed, so that a desired cutoff operation can be rapidly performed.

Specifically, an approach to an upper cutoff portion which was difficult to be performed with [in] a conventional oscillating saw can be easily performed.

In the present invention, direction of the handle and saw blade can be varied within a scope of approximately 90°, so that the cutoff surface and angle of the handle can be suitably adjusted in accordance with a change in angle of the saw blade.

The present invention is advantageous in that the size of the saw blade operation portion is minimized to allow free operation and a wide field of view in a narrow space of the oral cavity, the rotation power generated at the handle can be converted into a straight linear

reciprocating movement of the saw blade operation portion, and the direction of cutting a bone [cutting] has an angle of approximately 90° with respect to the approach direction. Thus, a significantly high efficiency in a bone cutting operation can be achieved since the bone cutting operation is performed by the linear reciprocating movements. In contrast to [Differently from] a conventional sagittal type saw, the reciprocating saw of the present invention allows a smooth operation even in a narrow space, ensuring a wide field of view. The bone cutting surgery can be performed only by partially cutting the oral cavity. In addition, a portion such as [like] an upper cutoff portion of a mandible to which a conventional saw has [a] difficulty in approaching, can be easily approached and cutoff performed with [adopting] the present invention.

A s[S]aw or file of the present invention can be replaced by each other. Therefore, it is possible to rapidly replace a saw or a file with each other in accordance with the shapes of the cutoff portion.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

Marked-up Version of Claims in Accordance with

Requirements under 37 C.F.R. §1.121

1. (Amended) A reciprocating surgical tool [saw] for use in an oral cavity [bone cutting] operation, [in which said saw is made up of] comprising a handle, a neck extending[ed] from said handle at a first end, and a head case [to be] coupled to a[n] second end of said neck[,]; a motor [is] mounted inside of said handle[,]; a slider shaft [is] mounted inside of said head case having [to have] an angle of approximately 90° with respect to a longitudinal axis of said neck[,]; a slider movable [which moves] in a [straight] linear reciprocating[ly] direction along said slider shaft [is mounted,]; a tool member mounted to said slider for performing said oral cavity operation; and [said slider and a motor are coupled by] a power linkage device coupled between said slider and said motor for converting rotation power of said motor into [a straight] linear reciprocating movement of said slider [and transmitting converted movement], whereby a direction of the oral cavity [bone cutting] operation performed by said tool [a saw] member [or a file member attached] mounted to said slider forms an angle of approximately 90° with respect to the longitudinal axis of the neck [an approach direction of said handle].

2. A reciprocating surgical tool [saw for use in oral cavity bone cutting operation] according to Claim 1, wherein said power linkage device comprises [is structured in that] a linkage shaft [is] inserted into [inside of] said neck, such [so] that both ends of said linkage shaft are [can be] supported by a bearing, [and] one end of said linkage shaft being [is] directly coupled to said motor while the other end of said linkage shaft has an expanded member at which an eccentric groove is formed, [and said slider also has an eccentric groove,] and a pin, a first [both] bent end[s] of the [a] pin being [are] inserted into said eccentric groove[s] of said

expanded member and a second bent end of the pin being inserted into an eccentric groove of said slider, respectively.

3. A reciprocating surgical tool [saw for use in oral cavity bone cutting operation] according to Claim 1, wherein said power linkage device comprises [uses] a gear element connected to a rotation shaft of said motor so as to convert the direction of rotation movement of said motor into a right angle[, and]; an eccentric wheel shaft [is] coupled to an end of said gear element[, and]; and an L-shaped link located within [is employed inside of] said head case, such [so] that an arrest point of said L-shaped link is [can be] fixed to said head case by a first hinge [and], an upper end of said L-shaped link being [can be] coupled to said slider by a second [another] hinge, and a lower end of said L-shape link being [is] connected to an eccentric wheel by a rod.

4. A reciprocating surgical tool [saw for use in oral cavity bone cutting operation] according to Claim 1, wherein said power linkage device comprises [is structured in that] an eccentric wheel [is] coupled to an end of said motor[, and]; and a second slider for [which performs straight] linear reciprocating movement along a slider shaft being position within [is arranged inside of] said handle for [so as to be] coupling[ed] to said eccentric wheel[,]; and wherein said slider and second slider are connected by a lever having at a center thereof a rotation shaft.

Marked-up Version of the abstract in Accordance with

Requirements under 37 C.F.R. §1.121

A reciprocating saw for use in oral cavity bone cutting operations, [in which] including [the saw consists of] a handle, a neck extended from the handle, and a head case to be coupled to an end of the neck. [, a] A motor is mounted inside of the handle. [, a] A slider shaft is mounted inside of the head case to form an angle of approximately 90° with respect to the neck, and [a slider which] moves in a straight linear reciprocating[ly] direction along the slider shaft which is mounted. [, and t] The slider and the [a] motor are coupled by a power linkage device for converting rotational power of the motor to a straight linear reciprocating movement of slider [and transmitting the converted movement,] whereby a direction of the bone cutting operation performed by a saw member or a file member attached to the slider forms an angle of approximately 90° with respect to an approach direction of the handle, and provides a significantly high efficiency in bone cutting operations since the bone cutting operation can be performed in a narrow space, while ensuring a wide field of view. In addition, [a portion like] an upper cut_off portion of a mandible to which a conventional saw has a difficulty in approaching, can be easily approached and cut_off.

SUBSTITUTE SPECIFICATION

RECIPROCATING SURGICAL TOOL FOR USE AT VARIABLE ANGLES AND IN MULTIPLE DIRECTIONS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a surgical saw for use in a bone cutting operation, and more particularly, to a reciprocating saw for use in cutting oral cavity bone, when an oral cavity bone cutting operation is performed by a linear reciprocation movement of the reciprocating saw blade without restriction within an approach direction.

2. Background Art

Reciprocating saws for surgical cutting operations of oral cavity bone are commonly used in plastic surgery. Since a bone cutting operation is preferably performed in a narrow space of the oral cavity, it is required to minimize the size of the reciprocating saw used therein. In addition, the optimization of bone cutting directions significantly affects the degree of difficulty, in a required limited time period, and pre-treatment for a surgical operation will also add to optimization of the procedure. However, a conventional surgical cutting saw does not provide such optimization of the surgical procedure.

As a conventional saw for surgical cutting operations, there are a sagittal saw, the saw blade of which is formed in the same direction as a handle thereof, as shown in FIG. 10, and an oscillating saw, the saw blade of which is formed to allow cuttings in a perpendicular direction with respect to a handle of the saw, as shown in FIGS. 11a and 11b even though the saw is

installed the same direction as the handle thereof. The sagittal saw has a problem in that changing cutting directions is not easy and a large external cutoff portion is inevitable to ensure a certain space required for inserting a saw and cutting a bone because the approach direction of the saw is the same as the direction of cutting a bone. The oscillating saw also has a problem in that the efficiency of the cutting operation is low and determining the direction for bone cutting is extremely difficult to form a circular shape.

For example, when a protruding portion of a mandible 100 has to be removed by being cut in a circular shape, the sagittal saw has an excellent cutting force. However, as shown in FIG. 10, an additional cut-off portion 101 is required to be formed at an outer skin, which delays a recovery time period and makes the surgical operation more complicated. The oscillating saw is advantageous in that the pre-cutoff portion can be minimized by inserting the saw blade thereof after partially cutting the oral cavity (oral cavity cutoff portion 102). However, as shown in FIG. 11a, when an upper portion of the mandible is cut-off (at point p), the saw handle is caught by the oral cavity cutoff portion 102, which causes difficulty in determining directions and angles.

A typical oscillating saw is generally used when a bone cutting operation is performed in a direction of an angle different from the direction of the saw handle. However, if the angle is not perpendicular to the handle, i.e., if the angle is not 90° with respect to the handle, or a circular action is partially included, the cutoff operation is inefficient. (Referring to FIG. 11b, when the cutting operation is to be performed in x-axis direction, the efficiency of cutting operation is degraded since a circular action occurs, forming an arc at x-y surface.)

Summary of the Invention

Therefore, it is an object of the present invention to allow an easy change in cutoff angle in a narrow space, minimization of a pre-cutoff portion, and enhancement in efficiency of the cutoff operation.

To accomplish the above object of the present invention, there is provided a reciprocating saw for use in a cutoff procedure for oral cavity bone, when the saw blade operation portion has a minimized size so as to allow for its effective use in a narrow space, and a saw blade or a file reciprocates linearly while maintaining a predetermined angle with respect to an approach direction, to thereby allow a free setup of bone cutting directions.

Brief Description of the Drawings

FIG.1 is a side sectional view of a reciprocating saw according to the present invention;

FIG. 2a is a side elevational view of the reciprocating saw shown in FIG. 1;

FIG. 2b is a side partial sectional view of a reciprocating saw having two slider axes according to a preferred embodiment of the present invention;

FIG. 3 is an exploded perspective view of a slider coupling portion for the saw blade according to the present invention;

FIG. 4 is a side sectional view of a modified configuration of a reciprocating saw shown in FIG. 1 ;

FIG. 5 illustrates several types of saw blades and files for use with the present invention;

FIG. 6 is a side sectional view of another preferred embodiment of a reciprocating saw according to the present invention;

FIG. 7 is a side sectional view of a modified configuration of the reciprocating saw shown in FIG. 6;

FIGS. 8a and 8b are sectional views of another preferred embodiment of the present invention;

FIG. 9 is a side elevational view showing the reciprocating saw when the reciprocating saw of the present invention is in use ; and

FIGS. 10, 11a, and 11b illustrate configurations and use states of a conventional sagittal saw and a conventional oscillating saw.

DETAILED DESCRIPTION OF THE PREFERED EMBODIMENTS

A preferred embodiment of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, like reference numerals identify similar or identical elements throughout the several views, while well-known functions or constructions are not described in detail so as not to obscure the invention in unnecessary detail.

Referring to FIGS. 1 through 3, a reciprocating saw of the present invention includes a handle 1, a neck 2 which is extended from the handle 1, and a head case 3 coupled to the other end of neck 2. In detail, handle 1 includes in the case of the handle 1, a motor 4, and head case 3 includes a slider shaft 5 which forms an angle of approximately 90° with respect to longitudinal direction of the neck 2. Slider 6 is mounted on slider shaft 5, and saw blade 8 is mounted to slider 6 to perform a linear reciprocating cutting motion along the slider shaft 5. Slider 6 and motor 4 are connected by a power linkage device 7 for converting the rotating power of motor 4 into a linear reciprocating cutting motion of slider 6 and transmitting the

converted motion to a saw 8 or a file 9 attached to the slider 6, which performs a liner reciprocating cutting motion.

Handle 1 is preferably shaped as a cylinder to which the force of an operator is applied when a bone cutting operation is performed. Handle 1 includes in the cylinder case of handle 1 a motor 4, and outside thereof a switch 1a which turns on/off the motor 4 so as to control the cutting operation of the reciprocating saw.

Neck 2 connects the head case 3 with the handle 1, and is extended from the handle 1 in such a manner that the size of neck 2 is minimized to facilitate the movement of the reciprocating saw in the cutting operation when the saw is deeply inserted into an oral cavity. Components of power linkage device 7 are arranged in the neck 2.

Neck 2 may be formed in a straight linear type, or in a bent type if necessary, as shown in FIG. 4. In a bent type neck, it is possible to adjust a proceeding direction (approach direction) of the neck and a linear movement direction (bone cutting direction) of the saw blade by the bent angle of the neck.

Head case 3 provides a movement space for slider 6, and is structured to have a minimum size within a scope of allowing a minimum stroke distance of the saw, so that a smooth operation of the saw can be achieved when the saw is inserted into an oral cavity.

When the range of the stroke pitch distance is 2.5mm to 3mm (which is the same as the stroke pitch distance of the slider; designated as "L" in FIG. 1), the head case has a width of approximately 5mm and a length of approximately 12mm, thus ensuring a greater movement space for the slider to maximize the stroke pitch distance of the saw. Furthermore, free control of the bone cutting directions and angles can be achieved.

Referring to FIG. 3, slider shaft 5 is installed in the head case 3 in order to induce a linear movement of slider 6. Here, the slider shaft 5 is preferably shaped as a hexagon so as not to be warped during a linear reciprocating movement of slider 6. When the neck 2 is a straight line type, the slider shaft 5 may have a variation of approximately 90° with respect to the neck 2, to thereby achieve a variety of bone cutting directions in conformity with the shapes of cutting portions of the bones.

The above-mentioned hexagonal shape of the slider shaft is for preventing a warpage during slider movements, and can be preferably formed as a cylindrical shaft as shown in FIG. 2b, wherein two slider axes may be arranged in parallel to each other so as to prevent warpage.

Slider 6 performs a linear reciprocating movement along the slider shaft 5 within the head case 3, and has preferably a hexagonal perforation 6a penetrating through a body of slider 6. Slider shaft 5 is assembled into the perforation 6a.

At an outer surface of slider 6, at least one screw hole 6b is formed for a replacement mounting of a saw blade or a file.

Saw blade 8 or file 9 serves to cut a bone, and has at an end portion thereof at least one coupling hole 8a or 9a so as to be coupled to the slider 6 using at least one screw 10, as seen in FIG. 5, which illustrates saw blades 8 and files 9, both of which can have various shapes if necessary.

In the present invention, various embodiments are possible according to the configurations of power linkage device 7 for converting rotation power to a linear reciprocating movement of slider 6 and transmitting the converted movement. Power linkage device 7, as shown in FIGS. 1 through 3, converts the rotating movement of motor 4 to a reciprocating movement of slider 6 using a linkage shaft 71a. Here, linkage shaft 71a is inserted into the neck

2, so that both ends of linkage shaft 71a can be supported by bearings 71b. At such a state, one end of linkage shaft 71a is directly coupled to the motor 4 while the other end of linkage shaft 71a has an expanded member 71c at which an eccentric groove 71d is formed. Slider 6 also has an eccentric groove 6c, and both bent ends of a pin 71e are inserted into the eccentric grooves 71d and 6c, respectively.

In the thus-structured power linkage device, rotating movement of motor 4 is transmitted to linkage shaft 71a, thus providing pin 71e with an eccentric movement at an end of linkage shaft 71a. Then, slider 6 to which the eccentric movement of pin 71e is transmitted slides along slider shaft 5 and thus moves in linear reciprocation perpendicular to linkage shaft 71a. Such a linear reciprocating movement of slider 6 is transmitted to the file or saw blade attached thereto, to thereby perform a bone cutting operation.

Such a power linkage device has a simplified structure, providing conversion of rotating movement of motor into a linear reciprocating movement, and thus minimization of neck size.

As shown in FIG. 4, a linkage shaft may be formed in a flexible cable shaft 71a', so that rotation thereof is enabled even when the neck portion is bent by a predetermined angle. This allows diversity of angles in approach directions and bone cutting directions.

The power linkage device shown in FIG. 6 has another preferred structure in that the handle portion converts rotation movement of motor 4 to a linear reciprocating movement at the slider using a link node.

That is, a gear element 72a connected to a rotation shaft of motor 4 converts the direction of rotating movement of motor 4 into a right angle. Then, an eccentric wheel shaft 72b is coupled to an end of gear element 72a. L-shaped link 72c is employed inside of head case 3, so that the arrest point of link 72c can be fixed to head case 3 by a hinge 72d and the

upper end of link 72c can be coupled to the slider 6 by a hinge 72e. The lower end of link 72c is connected to the eccentric wheel by a rod 72f.

In the above-described configuration, the eccentric wheel shaft 72b is rotated in accordance with the rotation of motor 4, and the rod 72f connected thereto performs crank movements back and forth. Then, the crank movement is transmitted to a linear reciprocating movement by link 72c, thereby linearly reciprocating slider 6.

The above-described configuration is advantageous in that a gear element which is required for changing the direction of power is provided to a handle portion which is not directly related to a bone cutting operation. In addition, internal components of the head case to be directly inserted into bone cutting portion is formed of a thin plate, to thereby minimize the sizes of the head case and handle portion.

FIG. 7 illustrates a modified configuration of the embodiment shown in FIG. 6 where slider shaft 5 is slanted with respect to neck 2. Here, a bone cutting direction is varied by an angle of approximately 90° with respect to the approach direction, and the angle of 90° may be reduced if necessary. Such a configuration may be applied regardless of the configuration of a power linkage device, and is effective for cutting a bone in a narrow portion.

FIG. 8a illustrates another preferred configuration of a power linkage device for converting a rotation movement of the motor into a straight linear movement using a lever 73e moving from right and left in the drawing. An eccentric wheel 73a is coupled to an end of motor 4, and a second slider 73c which performs a straight linear reciprocating movement along a slider shaft 73b is arranged inside of handle 1 and connected to eccentric wheel 73a. Slider 6 and second slider 73c are connected by a lever 73e having at a center thereof a rotation shaft 73d.

The modified configuration of the embodiment as shown in FIG. 8b is also possible, wherein the power linkage device is bent at a center thereof focused in rotation shaft 73d.

In such a configuration, the eccentric wheel and the second slider constitute a cam element so that the rotating movement of the eccentric wheel can be directly converted into a straight linear reciprocating movement of the second slider. In addition, the slider which constitutes a saw blade operation portion is provided with a straight linear reciprocating movement by the lever which performs an angular movement being centered at rotation axis 73d.

The above-described configuration is minimally disadvantageous in that a neck portion thereof becomes more or less larger since displacement at both ends of the lever becomes larger. However, the head case is formed integrally with the neck portion so as to allow a more smooth operation, and the width of the neck portion is increased in accordance with the displacement of lever being centered at the rotation axis which has least displacement, to thereby provide a wide field of view when the operation is performed.

FIG. 9 illustrates a state of cutting the protrusion of a mandible into a circular shape using the reciprocating saw of the present invention. Here, oral cavity cutoff portion 102 is cut off first, and the saw blade is inserted thereinto. Then, the direction of the handle is appropriately adjusted in order to perform a cutting operation.

The direction of bone cutting to be performed by the saw blade is adjusted by means of appropriately adjusting the handle, and the direction of bone cutting forms an approximately 90° angle with respect to the approach direction of the handle. Therefore, free change in direction being centered from oral cavity cutoff portion 102 as an axis is allowed, so that a desired cutoff operation can be rapidly performed.

Specifically, an approach to an upper cutoff portion which was difficult to be performed with a conventional oscillating saw can be easily performed.

In the present invention, direction of the handle and saw blade can be varied within a scope of approximately 90°, so that the cutoff surface and angle of the handle can be suitably adjusted in accordance with a change in angle of the saw blade.

The present invention is advantageous in that the size of the saw blade operation portion is minimized to allow free operation and a wide field of view in a narrow space of the oral cavity, the rotation power generated at the handle can be converted into a straight linear reciprocating movement of the saw blade operation portion, and the direction of cutting a bone has an angle of approximately 90° with respect to the approach direction. Thus, a significantly high efficiency in a bone cutting operation can be achieved since the bone cutting operation is performed by the linear reciprocating movements. In contrast to a conventional sagittal type saw, the reciprocating saw of the present invention allows a smooth operation even in a narrow space, ensuring a wide field of view. The bone cutting surgery can be performed only by partially cutting the oral cavity. In addition, a portion such as an upper cutoff portion of a mandible to which a conventional saw has difficulty in approaching, can be easily approached and cutoff performed with the present invention.

A saw or file of the present invention can be replaced by each other. Therefore, it is possible to rapidly replace a saw or a file with each other in accordance with the shapes of the cutoff portion.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various

changes in form and details may be made therein without departing from the spirit and scope of the invention.

WHAT IS THE CLAIMED IS:

1. A reciprocating surgical tool for use in an oral cavity operation, comprising a handle, a neck extending from said handle at a first end, and a head case coupled to a second end of said neck; a motor mounted inside of said handle; a slider shaft mounted inside of said head case having have an angle of approximately 90° with respect to a longitudinal axis of said neck; a slider movable in a linear reciprocating direction along said slider shaft; a tool member mounted to said slider for performing said oral cavity operation; and a power linkage device coupled between said slider and said motor for converting rotation power of said motor into linear reciprocating movement of said slider, whereby a direction of the oral cavity operation performed by said tool member mounted to said slider forms an angle of approximately 90° with respect to the longitudinal axis of the neck.

2. A reciprocating surgical tool according to Claim 1, wherein said power linkage device comprises a linkage shaft inserted into said neck, such that both ends of said linkage shaft are supported by a bearing, one end of said linkage shaft being directly coupled to said motor while the other end of said linkage shaft has an expanded member at which an eccentric groove is formed, and a pin, a first bent end of the pin being inserted into said eccentric groove of said expanded member and a second bent end of the pin being inserted into an eccentric groove of said slider, respectively.

3. A reciprocating surgical tool according to Claim 1, wherein said power linkage device comprises a gear element connected to a rotation shaft of said motor so as to convert the direction of rotation movement of said motor into a right angle; an eccentric wheel shaft coupled to an end of said gear element; and an L-shaped link located within said head case,

such that an arrest point of said L-shaped link is fixed to said head case by a first hinge, an upper end of said L-shaped link being coupled to said slider by a second hinge, and a lower end of said L-shape link being connected to an eccentric wheel by a rod.

4. A reciprocating surgical tool according to Claim 1, wherein said power linkage device comprises an eccentric wheel coupled to an end of said motor; and a second slider for linear reciprocating movement along a slider shaft being position within said handle for coupling to said eccentric wheel; and wherein said slider and second slider are connected by a lever having at a center thereof a rotation shaft.

5. A reciprocating saw for use in an oral cavity bone cutting operation, comprising:

a handle;

a motor;

a linkage for converting rotating power of said motor into linear reciprocating movement;

a slider shaft mounted at and end of said linkage having an angle of approximately 90° with respect to the linkage; and

a slider, for attaching one of a saw and a file, which moves reciprocatingly along said slider shaft, whereby a direction of a bone cutting operation performed by the saw or file attached to said slider forms an angle of approximately 90° with respect to a longitudinal axis of said handle.

6. A reciprocating saw according to Claim 5, further comprising a switch for turning on/off the motor.

7. A reciprocating saw according to Claim 5, wherein said linkage includes:

a linkage shaft connected between the motor and the slider for transmitting the rotating power from the motor to the slider;

the slider having at least one eccentric groove; and

a pin having a pair of bent ends, such that one bent end is inserted into the eccentric groove of the slider while the other end is inserted into an eccentric groove of the linkage shaft, whereby the rotating power of the motor is converted into linear reciprocating movement of slider.

8. A reciprocating saw according to Claim 7, further comprising at least one bearing to support the linkage shaft.

9. A reciprocating saw according to Claim 7, wherein the linkage has a curved shape for adjusting a working direction and bone cutting direction.

10. A reciprocating saw according to Claim 5, wherein the linkage includes:

a gear element consisting of two gears perpendicularly engaged with each other , one of which is connected to a rotation shaft of said motor and the other of which connected to an eccentric wheel shaft, in order to convert a direction of rotation movement of said motor into a right angle;

the eccentric wheel shaft being connected to a rod so that the rotating power of the gear is transferred to the rod;

the rod being connected to a lower portion of an L-shaped link so that the reciprocating movement of the rod is transmitted to the lower portion of the L-shape link; and

an upper portion of the L-shaped link being connected to the slider such that it pivotably moves up and down along the slider by transmitted movements of the rod through a hinge, whereby the rotating power of the motor is converted into a linear reciprocating movement of slider.

11. A reciprocating saw according to Claim 10, wherein the L-shape link is installed in a head case at an end of the linkage opposite said handle.

12. A reciprocating saw according to Claim 5, wherein said linkage includes:

a eccentric wheel coupled to an end of the motor; and

a second slider connected to the eccentric wheel and for reciprocating movement along the slider shaft; wherein the slider is connected to the second slider by a lever having at a center thereof a rotation shaft.

13. A reciprocating saw according to Claim 12, wherein the lever has a bent shape.

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RECIPROCATING SAW FOR USE IN VARIABLE ANGLE AND MULTIPLE DIRECTION

Field of the Invention

The present invention relates to a unique saw for use in esthetic facial bone surgery, and more particularly, to a modified reciprocating saw for use in mandibular angle resection in which the mandibular angle can be resected by a linear reciprocation movement of saw blade without being restricted in approach direction.

Background Art

Several types of saw have been used in esthetic mandibular angle resection surgery. Since bone cutting operation is performed in a narrow space of oral cavity, it is required to minimize the saw used therein. In addition, optimization in bone cutting direction affects significantly to the degree of difficulty, required time period, and final outcome of the operation. However, conventional surgical cutting saws do not provide such an optimization.

As a conventional saw for surgical cutting operation, there is a conventional reciprocating saw of which saw blade is formed in the same direction as a handle thereof, as shown in FIG. 10, and an oscillating saw of which saw blade is formed to allow cuttings in perpendicular direction with respect to a handle of the saw, as shown in FIGs. 11a and 11b. The conventional reciprocating saw has a problem in that direction change is not easy and an external skin incision is required and an intraoral incision becomes large so as to ensure space required for insertion and bone cutting since the approach direction and bone cutting direction are the same. The oscillating saw has a problem in that efficiency of cutting operation is low since cutting movement is on a part of a circle, and determination on the direction for bone cutting is extremely difficult since approach and motion of the shaft are limited by adjacent structures.

For example, when a protruded portion of a mandible angle 100 has to be removed by being cut in a circular shape, the conventional reciprocating saw shows an excellent cutting force. However, as shown in FIG. 10, an additional incision 101 is required to be formed at an outer

skin, which delays recovery time period and makes surgical operation more complicated. The oscillating saw is advantageous in that the incision is made only in oral cavity (intraoral incision 102). However, as shown in FIG. 11a, when an upper portion of the mandible angle is cut-off (at point p), the saw handle and the shaft are caught by the limited intraoral incision 102 and the body of zygoma, which causes difficulty in determination on direction and angle.

A typical oscillating saw is employed when bone cutting operation is performed in an angle different from the direction of the saw handle. However, if the angle is not perpendicular to the handle, i.e., if the angle is not 90° with respect to the handle, a circular action is partially included, thus making cutoff operation inefficient. (referring to FIG. 11b, when cutting operation is to be performed in x-axis direction, efficiency of cutting operation is degraded since a circular action occurs, forming an arc at x-y surface)

Additionally, oscillating saw blade has limited width, so it is very difficult to cut the end of bone to be resected in the same direction with that of primary position.

Summary of the Invention

Therefore, it is an object of the present invention to allow an easy change in cutting angle in a narrow space, minimization in incision, and enhancement in an efficiency of intraoral bone surgery.

To accomplish the above object of the present invention, there is provided a new type of saw for use in intraoral bone surgery, particularity mandibular angle resection in which saw operation portion to be inserted has a minimized size so as to allow an effective use in a narrow space, and saw blade or file reciprocates linearly at a state maintaining a predetermined angle with respect to an approach direction, to thereby allow a free setup of bone cutting direction and angle.

Brief Description of the Drawings

FIG.1 illustrates a basic configuration of a reciprocating saw according to the present invention;

FIG. 2a illustrates an external shape of the reciprocating saw shown in Fig. 1;

FIG. 2b illustrates a reciprocating saw having two slider axes according to an embodiment of the present invention;

FIG. 3 is a perspective view illustrating a configuration of a slider coupling portion according to the present invention;

FIG. 4 illustrates a modified configuration of a reciprocating saw according to the present invention;

FIG. 5 illustrates saw blade and file adopted to the present invention;

FIG. 6 illustrates a reciprocating saw according to another embodiment of the present invention;

FIG. 7 illustrates a modified configuration of the reciprocating saw shown in FIG. 6;

FIGs. 8a and 8b illustrate still another embodiment of the present invention;

FIG. 9 illustrates a state where the reciprocating saw of the present invention is applied;

FIG. 10 illustrate configuration and use state of an conventional reciprocating saw; and

Figlla, 11b illustrate configuration and use state of an oscillating saw.

Detailed Description of the Invention

Referring to FIGs.1 through 3, a reciprocating saw of the present invention includes a handle 1, a neck 2 which is extended from handle 1, and a head case 3 coupled to an end of neck 2. In detail, handle 1 has inside thereof a motor 4, and head case 3 has inside thereof a slider shaft 5 which forms an angle of approximately 90° with respect to neck 2. Slider 6 is mounted to perform a linear reciprocating motion along slider shaft 5. Slider 6 and motor 4 are connected by a power linkage device 7 for converting rotation power of motor 4 into a linear reciprocating motion of slider 6 and transmitting the converted motion. Thus, a saw 8 or a file 9 attached to slider 6 performs a liner reciprocating motion.

Handle 1 is shaped as a cylinder to which force of an operator is applied when bone cutting operation is performed. Handle 1 includes inside thereof motor 4, and outside thereof a switch 1a which turns

on/off motor 4 so as to control the cutting operation.

Neck 2 connects head case 3 with handle 1, and is extended from handle 1 in such a manner that the size of neck 2 is minimized so as not to disturb the cutting operation when the saw is deeply inserted into an oral cavity. Components of power linkage device 7 are arranged inside of neck 2.

Neck 2 can be formed in straight line type, or in bent type if necessary, as shown in FIG. 4. In a bent type neck, it is possible to adjust a proceeding direction (approach direction) of the neck and a linear movement direction (bone cutting direction) of the saw blade by the bent angle of the neck.

Head case 3 is for ensuring movement space of slider 6, and structured to have a minimum size within a scope of allowing a minimum stroke distance of the saw, so that a smooth operation of the saw can be achieved when inserted into an oral cavity.

When the stroke distance of the saw is 2.5mm to 3mm (which is the same as the stroke distance of the slider; denoted as "L" in FIG. 1), the head case has width of approximately 5mm and length of approximately 12mm in sectional surface, thus ensuring movement space of the slider and the minimum stroke distance of the saw. Further, free control of the bone cutting direction and angle can be achieved.

Slider shaft 5 is installed inside of head case 3 in order to induce linear movement of slider 6. Here, slide shaft 5 is shaped as a hexagon in sectional surface so as not to be warped during a linear reciprocating movement of slider 6. When neck 2 is straight line type, slider shaft 5 may have a variation of approximately 90° with respect to neck 2, to thereby achieve a bone cutting direction in conformity with the shape of cutting portion of the bone.

The above-mentioned hexagonal shape of the slider shaft is for preventing a warpage during slider movement, and can be formed as a cylindrical shaft as shown in FIG. 2a, wherein two slider axes are arranged in parallel to each other so as to prevent a warpage.

Slider 6 performs a linear reciprocating movement along slider shaft 5 within head case 3, and has a hexagonal perforation 6a penetrating through a body of slider 6. Slider shaft 5 is assembled into perforation 6a.

At an outer surface of slider 6, a screw hole 6b is formed for a replacement mounting of saw blade or file.

Saw blade 8 or file 9 serves to cut bone, and has at an end portion thereof a coupling hole 8a or 9a so as to be coupled to slider 6 using a screw 10.

FIG. 5 illustrates saw blade 8 and file 9, both can have various shape if necessary.

In the present invention, various embodiments are possible according to the configuration of power linkage device 7 for converting rotation power to a linear reciprocating movement of slider 6 and transmitting the converted movement. Power linkage device 7 as shown in FIGs. 1 through 3 is those which converts rotation movement of motor 4 to a reciprocating movement of slider 6 using a linkage shaft 71a. Here, linkage shaft 71a is inserted into inside of neck 2, so that both ends of linkage shaft 71a can be supported by a bearing 71b. At such a state, one end of linkage shaft 71a is directly coupled to motor 4 while the other end of linkage shaft 71a has an expanded member 71c at which an eccentric groove 71d is formed. Slider 6 also has an eccentric groove 6c, and both bent ends of a pin 71e are inserted into eccentric grooves 71d and 6c, respectively.

In the thus-structured power linkage device, rotation movement of motor 4 is transmitted to linkage shaft 71a, thus providing pin 71e with an eccentric movement at an end of linkage shaft 71a. Then, slider 6 to which the eccentric movement of pin 71e is transmitted slides along slider shaft 5 and thus moves in linear reciprocation. Such linear reciprocating movement of slider 6 is transmitted to the file or saw blade attached thereto, to thereby perform bone cutting operation.

Such a power linkage device has an extremely simplified structure, providing conversion of rotation movement of motor into a linear reciprocating movement and minimization of neck size.

As shown in FIG. 4, a linkage shaft may be formed in a flexible cable shaft 71a', so that rotation thereof is enabled even when the neck portion is bent by a predetermined angle. This allows diversity of angle in approach direction and bone cutting direction.

The power linkage device shown in FIG. 6 has a structure in that the handle portion converts rotation movement of motor 4 to a linear

reciprocating movement at the slide using a link node.

That is, a gear element 72a connected to a rotation shaft of motor 4 converts direction of rotation movement of motor 4 into a right angle. Then, an eccentric wheel shaft 72b is coupled to an end of gear element 72a, and an L-shaped link 72c is employed inside of head case 3, so that the arrest point of link 72c can be fixed to head case 3 by a hinge 72d and the upper end of link 72c can be coupled to slider 6 by a hinge 72e. The lower end of link 72c is connected to the eccentric wheel by a rod 72f.

The above-described configuration is that eccentric wheel shaft 72b rotates in accordance with the rotation of motor 4, and rod 72f connected thereto performs crank movement up and down. Then, the crank movement is transmitted to a linear reciprocating movement by link 72c, thereby linearly reciprocating slider 6.

The above-described configuration is advantageous in that a gear element which is required for changing the direction of power is provided to a handle portion which is not directly related to a bone cutting operation. In addition, internal component of a head case to be directly inserted into bone cutting portion is formed of a thin plate, to thereby minimize size of the head case and handle portion.

FIG. 7 illustrates an embodiment where slider shaft 5 is slant with respect to neck 2. Here, bone cutting direction is varied by an angle of approximately 90° with respect to the approach direction, and the angle of 90° may be reduced if necessary. Such a configuration may be applied in regardless of the configuration of a power linkage device, and is effective for bone cutting in a narrow portion.

FIG. 8a illustrates configuration of a power linkage device for converting rotation movement of motor into a straight linear movement using a lever moving right and left. An eccentric wheel 73a is coupled to an end of motor 4, and a second slider 73c which performs straight line reciprocating movement along a slider shaft 73b is arranged inside of handle 1 and connected to eccentric wheel 73a. Slider 6 and second slider 73c are connected by a lever 73e having at a center thereof a rotation shaft 73d.

The configuration as shown in FIG. 8b is also possible, wherein the power linkage device is bent at a center thereof focused in rotation

shaft 73d.

In such a configuration, the eccentric wheel and the second slider constitute a cam element so that the rotation movement of the eccentric wheel can be directly converted into a straight line reciprocating movement of the second slider. In addition, the slider which constitutes a saw blade operation portion is provided with a straight line reciprocating movement by the lever which performs angular movement being centered at rotation axis 73d.

The above-described configuration is disadvantageous in that a neck portion thereof becomes more or less larger since displacement at both ends of the lever becomes larger. However, the head case is formed integrally with the neck portion so as to allow more smooth operation, and the width of the neck portion is increased in accordance with the displacement of lever being centered at the rotation axis which has least displacement, to thereby provide a wide field of view when performing operation.

FIG. 9 illustrates a state of cutting the protrusion of a mandible angle into a circular shape using the reciprocating saw of the present invention. Here, intraoral incision 102 is made first, and the saw blade is inserted thereinto. Then, the direction of the handle is appropriately adjusted in order to perform a cutting operation.

Therefore, it is easy to cut the upper end of mandible angle by using exchangeable long blade.

The direction of bone cutting to be performed by the saw blade is adjusted by means of appropriately adjusting the handle, and the direction of bone cutting forms approximately 90° with respect to the approach direction of the handle. Therefore, free change in direction being centered from oral cavity incision 102 as an axis is allowed, so that a desired cutoff operation can be rapidly performed.

Specifically, an approach to an upper cutoff portion which was difficult to be performed in a conventional oscillating saw can be easily performed.

In the present invention, direction of handle and saw blade can be varied within a scope of approximately 90°, so that the cutoff surface and angle of the handle can be suitably adjusted in accordance with change in angle of saw blade.

The present invention is advantageous in that size of saw blade operation portion is minimized to allow free operation and field of view in a narrow space of oral cavity, the rotation power generated at the handle can be converted into a straight line reciprocating movement of the saw blade operation portion, and the direction of bone cutting has an angle of approximately 90° with respect to the approach direction. Thus, a significantly high efficiency in bone cutting operation can be achieved since the bone cutting operation is performed by the linear reciprocating movement. Differently from a conventional reciprocating saw, the new reciprocating saw of the present invention allows smooth operation even in a narrow space, ensuring a wide field of view. The bone cutting surgery can be performed only by intraoral incision. In addition, a portion like an upper cutoff portion of mandible angle to which a conventional saw has a difficulty in approaching, can be easily approached and cutoff adopting the present invention.

Saw or file of the present invention can be replaced by each other. Therefore, it is possible to rapidly replace saw or file with each other in accordance with the shape of the cutoff portion.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. A reciprocating saw for use in oral cavity bone cutting operation, in which said saw is made up of a handle, a neck extended from said handle, and a head case to be coupled to an end of said neck, a motor is mounted inside of said handle, a slider shaft is mounted inside of said head case to have an angle of approximately 90° with respect to said neck, a slider which moves straight linear reciprocatingly along said slider shaft is mounted, and said slider and a motor are coupled by a power linkage device for converting rotation power of said motor to a straight linear reciprocating movement of slider and transmitting converted movement, whereby direction of bone cutting operation performed by a saw member or a file member attached to said slider forms an angle of approximately 90° with respect to an approach direction of said handle.

2. A reciprocating saw for use in oral cavity bone cutting operation according to Claim 1, wherein said power linkage device is structured in that a linkage shaft is inserted into inside of said neck, so that both ends of said linkage shaft can be supported by a bearing, and one end of said linkage shaft is directly coupled to said motor while the other end of said linkage shaft has an expanded member at which an eccentric groove is formed, and said slider also has an eccentric groove, and both bent ends of a pin are inserted into said eccentric grooves of said expanded member and said slider, respectively.

3. A reciprocating saw for use in oral cavity bone cutting operation according to Claim 1, wherein said power linkage device uses a gear element connected to a rotation shaft of said motor so as to convert direction of rotation movement of said motor into a right angle, and an eccentric wheel shaft is coupled to an end of said gear element, and an L-shaped link is employed inside of said head case, so that an arrest point of said L-shaped link can be fixed to said head case by a hinge and an upper end of said L-shaped link can be coupled to said slider by another hinge, and a lower end of said L-shape link is connected to an eccentric wheel by a rod.

4. A reciprocating saw for use in oral cavity bone cutting operation according to Claim 1, wherein said power linkage device is

structured in that an eccentric wheel is coupled to an end of said motor, and a second slider which performs straight linear reciprocating movement along a slider shaft is arranged inside of said handle so as to be coupled to said eccentric wheel, and said slider and second slider are connected by a lever having at a center thereof a rotation shaft.

Abstract

A reciprocating saw for use in oral cavity bone cutting operations, including a handle, a neck extended from the handle, and a head case to be coupled to an end of the neck. A motor is mounted inside of the handle. A slider shaft is mounted inside of the head case to form an angle of approximately 90° with respect to the neck, and moves in a straight linear reciprocating direction along the slider shaft. The slider and the motor are coupled by a power linkage device for converting rotational power of the motor to a straight linear reciprocating movement of slider whereby a direction of the bone cutting operation performed by a saw member or a file member attached to the slider forms an angle of approximately 90° with respect to an approach direction of the handle, and provides a significantly high efficiency in bone cutting operations since the bone cutting operation can be performed in a narrow space, while ensuring a wide field of view. In addition, an upper cut off portion of a mandible to which a conventional saw has a difficulty in approaching, can be easily approached and cut off.

FIG 1

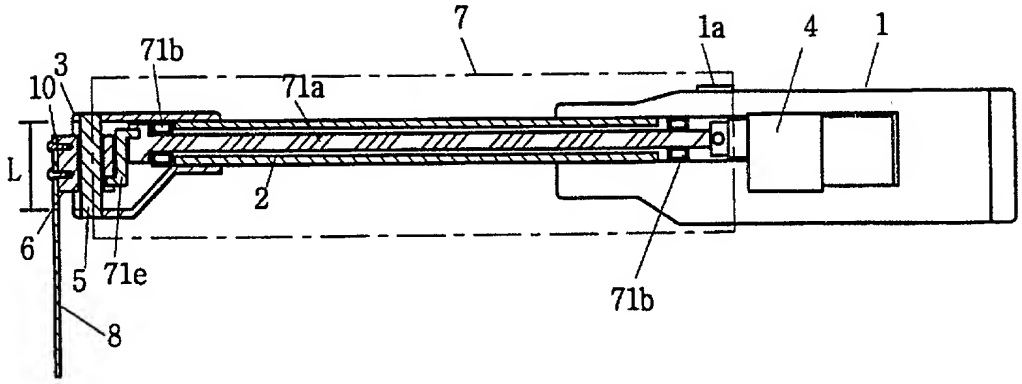


FIG 2a

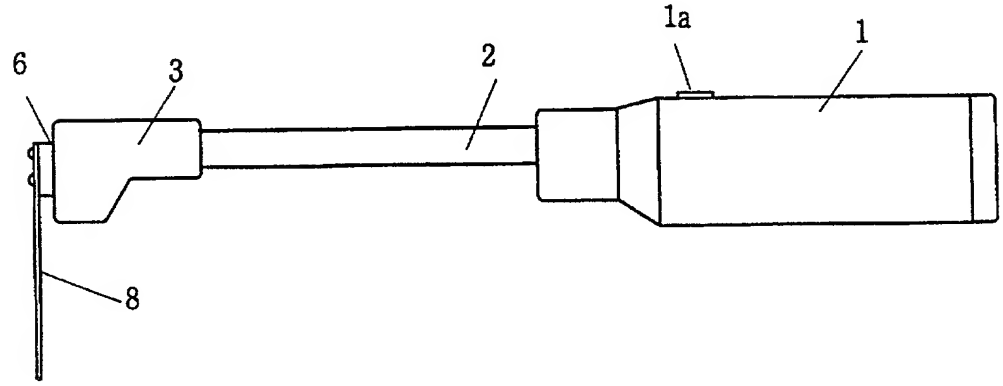


FIG 2b

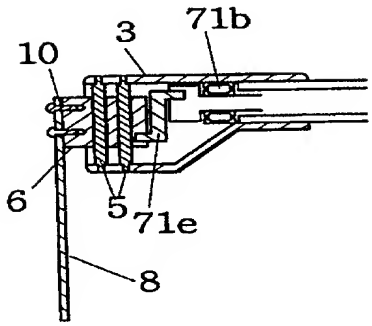


FIG 3

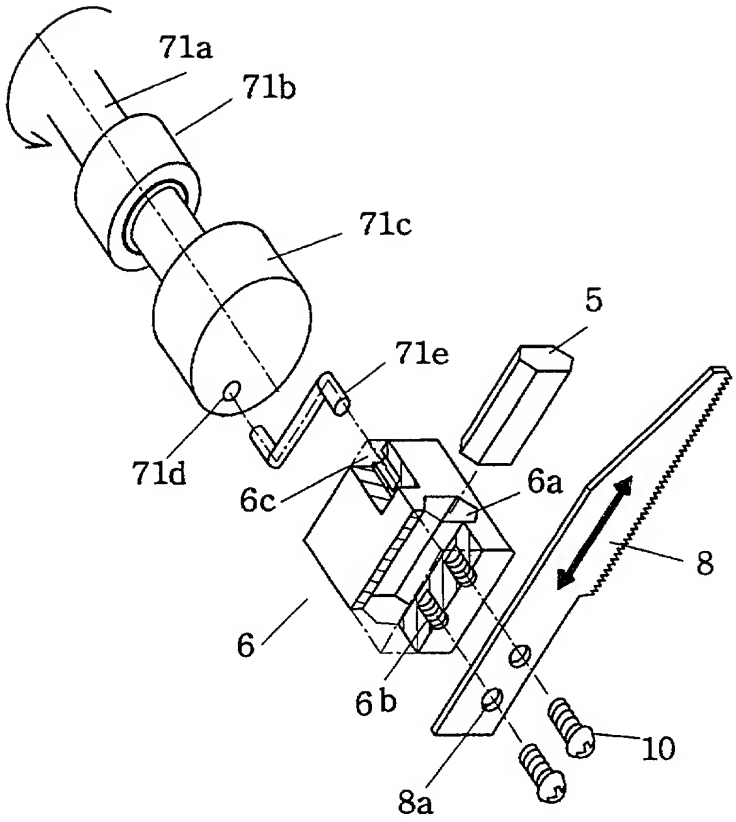


FIG 4

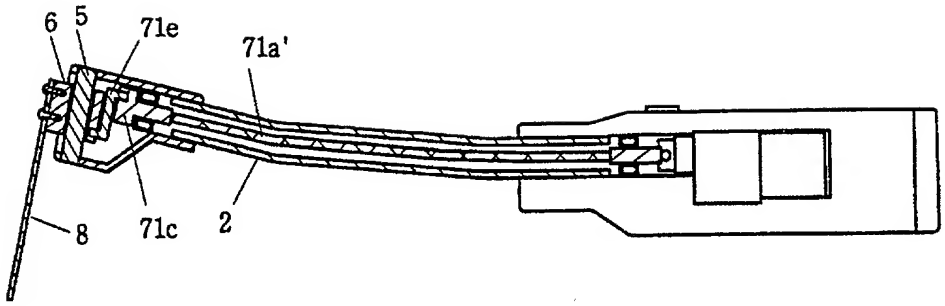


FIG 5

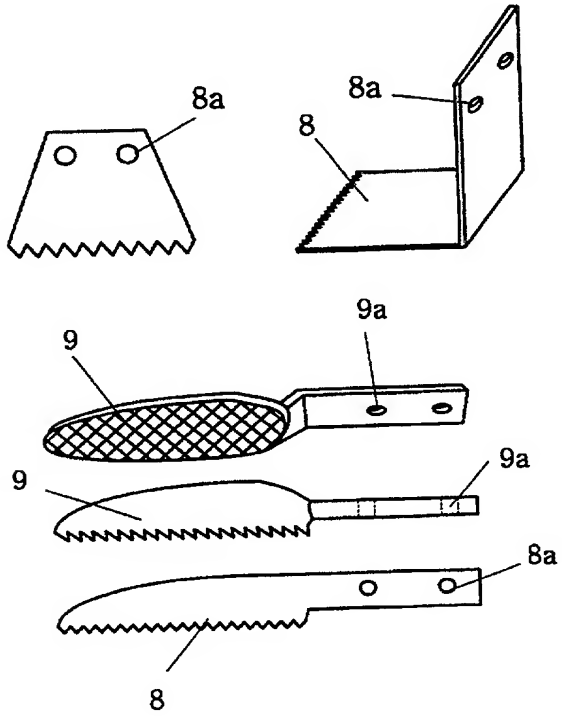


FIG 6

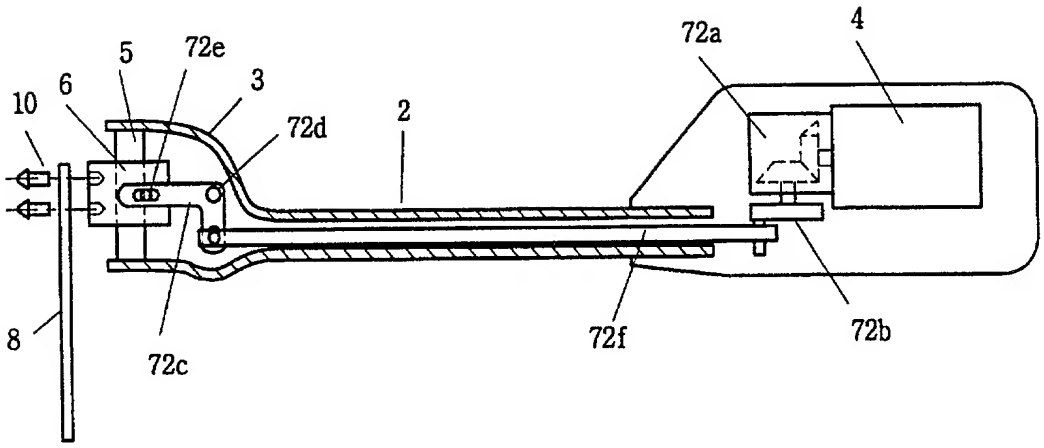


FIG 7

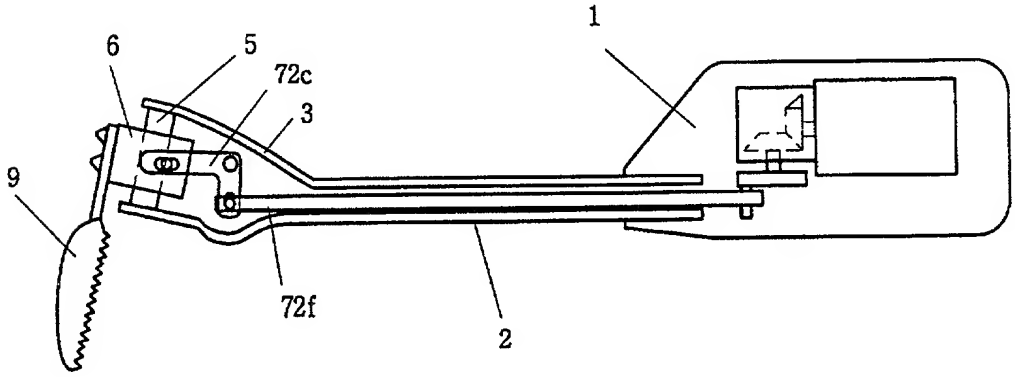


FIG 8a

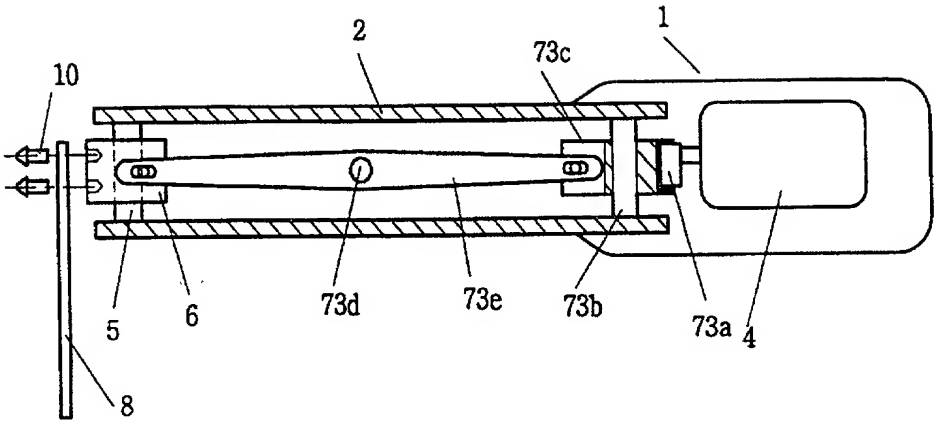


FIG 8b

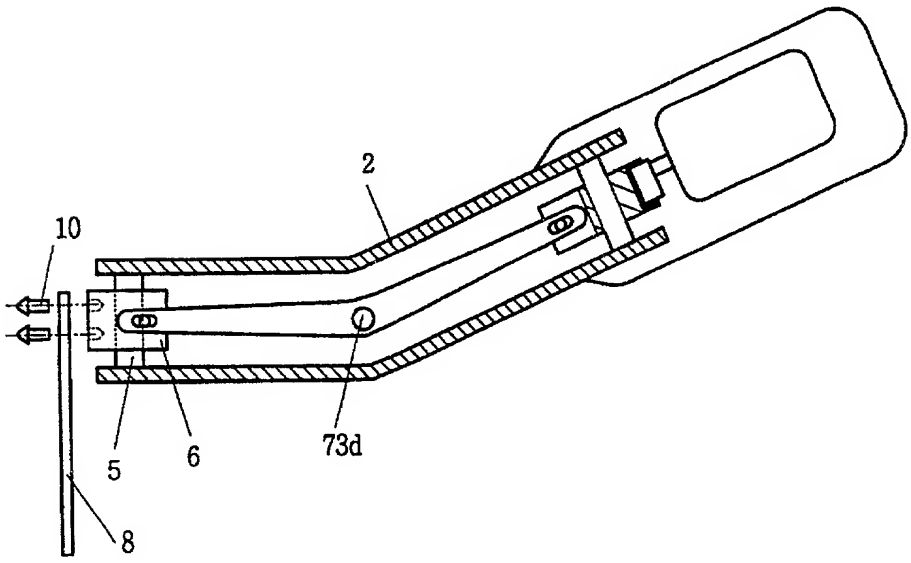


FIG 9

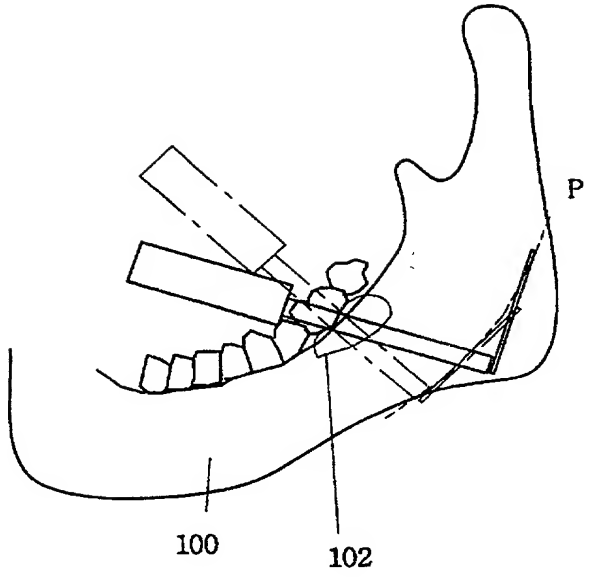


FIG 10

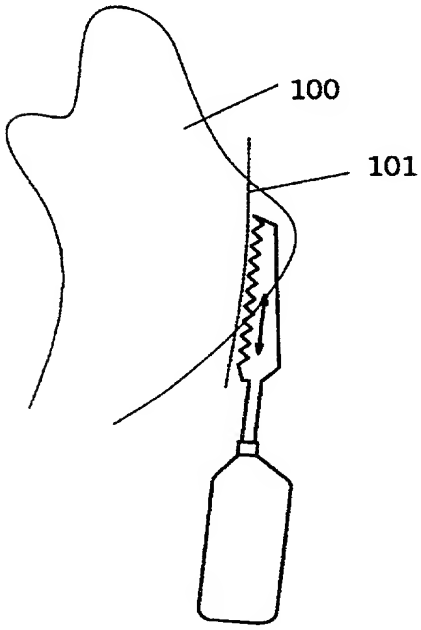


FIG 11a

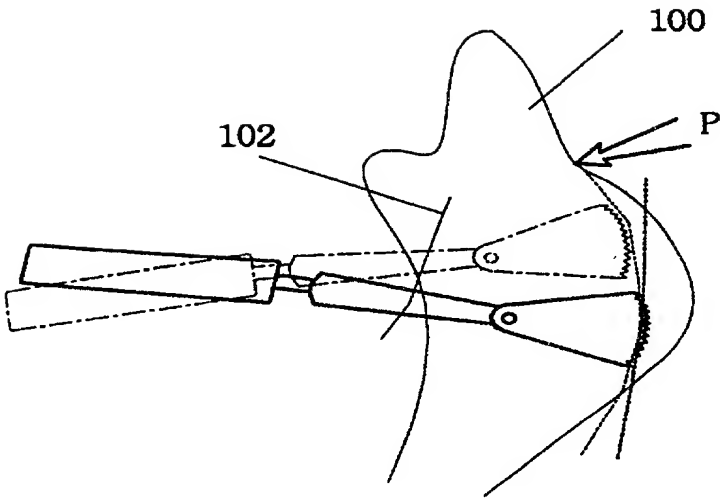
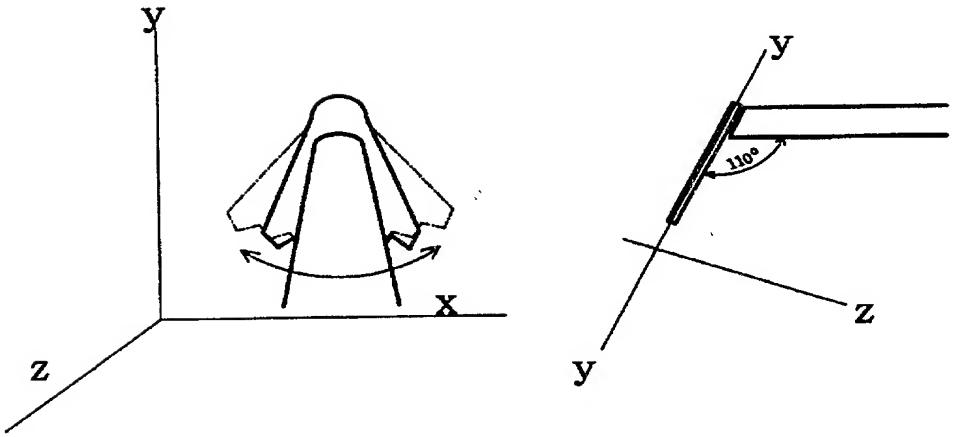


FIG 11b



DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name as it should appear on the filing receipt and all other documents.

Full name of **sole or first inventor** **Hee-Young LEE**

Inventor's signature /Heeyoung Lee

Date January 9, 2002 Country of Citizenship **KOREA**

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Post Office Address Same as above KRX

Full name of **second joint inventor**, if any

Inventor's signature

Date _____ Country of Citizenship

Residence

Post Office Address

ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CIP APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. '120.

POWER OF ATTORNEY

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(List name and registration number)*

PETER G. DILWORTH, Reg. No. 26,450; **ROCCO S. BARRESE**, Reg. No. 25,253; **DAVID M. CARTER**, Reg. No. 30,949; **PAUL J. FARRELL**, Reg. No. 33,494; **PETER DELUCA**, Reg. No. 32,978; **JEFFREY S. STEEN**, Reg. No. 32,063; **JOSEPH W. SCHMIDT**, Reg. No. 36,920; **RAYMOND E. FARRELL**, Reg. No. 34,816; **ADRIAN T. CALDERONE**, Reg. No. 31,746; **GEORGE M. KAPLAN**, Reg. No. 28,375; **RUSSELL R. KASSNER**, Reg. No. 36,183; **CHRISTOPHER G. TRAINOR**, Reg. No. 39,517; **GEORGE LIKOUREZOS**, Reg. No. 40,067; **EDWARD C. MEAGHER**, Reg. No. 41,189; **MICHAEL E. CARMEN**, Reg. No. 43,533, **HAROLD G. FURLOW**, Reg. No. 43,621; **DANIEL E. TIERNEY**, Reg. No. 33,461; **MICHAEL J. MUSELLA**, Reg. No. 39,310; **JUDY NAAMAT**, Reg. No. 39,311; **MICHAEL R. BREW**, Reg. No. 43,513; **MICHAEL J. PORCO**, Reg. No. 46,007; and **JOHN F. GALLAGHER**, Reg. No. 47,234; each of them of **DILWORTH & BARRESE, LLP**, 333 Earle Ovington Boulevard, Uniondale, New York 11553.

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Uniondale, New York 11553

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

Paul J. Farrell
(516) 228-8484

PRIORITY CLAIM (35 U.S.C. '119)(a)-(d)

I hereby claim foreign priority benefits under Title 35, United States Code, '119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d) ☐ no such applications have been filed.

(e) ☒ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. '119(a)-(d)

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING *(day, month, year)*	PRIORITY CLAIMED UNDER 35 U.S.C. 119
Korea	34321-1999	August 19, 1999	☒ YES ☐ NO
			☐ YES ☐ NO

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S) (34 U.S.C. '119(e))

I hereby claim the benefit under Title 35, United States Code, '119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER	FILING DATE
__/_____	_____
__/_____	_____

SPECIFICATION IDENTIFICATION

the specification of which: *(complete (a), (b) or (c))*

(a) ☐ is attached hereto.

(b) ☐ was filed on _____ as ☐ Serial No. 0 / _ or ☐ Express Mail No., as Serial No. not yet known _____ and was amended on _____ *(if applicable)*.

NOTE: Amendments filed after the original papers are deposited with the PTO which contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 C.F.R. 1.67.

(c) ☒ was described and claimed in PCT International Application No. **PCT/KR 99/00717** filed on **November 29, 1999** and as amended under PCT Article 19 on _____ *(if any)*.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. '1.56, and

☐ in compliance with this duty there is attached an information disclosure statement in accordance with 37 C.F.R. 1.98.

PATENT
Attorney's Docket No. 1178-2

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: *(check one applicable item below)*

☒ original
☐ design
☐ supplemental

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application do ~~not~~ check next item; check appropriate one of last three items.

☒ national stage of PCT

NOTE: If one of the following 3 items apply then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR CIP.

☐ divisional
☐ continuation
☐ continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

RECIPROCATING SAW FOR USE IN VARIABLE ANGLE AND MULTIPLE DIRECTION

ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CIP APPLICATION

(complete this part only if this is a divisional, continuation or CIP application)

CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATION(S) UNDER 35 U.S.C. 120

I hereby claim the benefit under Title 35, United States Code, '120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claim of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, '112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, '1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		**Status** *(Check One)*		
U.S. APPLICATIONS	**U.S. FILING DATE**	**Patented**	**Pending**	**Abandoned**
1. 0 /				
2. 0 /				
3. 0 /				
4. 0 /				
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO.	**PCT FILING DATE**	**U.S. SERIAL NOS. ASSIGNED** *(if any)*		

5. PCT/KR99/00717	November 29, 1999				
6.					
7.					
8.					

35 U.S.C. 119 PRIORITY CLAIM, IF ANY, FOR ABOVE LISTED U.S./PCT APPLICATIONS

ABOVE APPLICATION NO.	DETAILS OF FOREIGN APPLICATION FROM WHICH PRIORITY CLAIMED UNDER 35 U.S.C. 119		
	Country Application No.	Date of filing *(day, month, year)*	Date of issue *(day, month, year)*
1.	Korea 34321-1999	19 August 1999	
2.			
3.			
4.			
5.			
6.			

CHECK PROPER BOX(ES) FOR ANY OF THE FOLLOWING ADDED PAGE(S) WHICH FORM A PART OF THIS DECLARATION

☐ Signature for subsequent joint inventors.
Number of pages added _____.

☐ Signature by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor.
Number of pages added _____.

☐ Signature for inventor who refuses to sign or cannot be reached by person authorized under 37 C.F.R. '1.47.
Number of pages added _____.

***

☐ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (CIP) application.
Number of pages added _____.

***

☐ Authorization of attorney(s) to accept and follow instructions from representative.

***

If no further pages form a part of this Declaration then end this Declaration with this page and check the following item.

☐ This declaration ends with this page.